FOREST PRODUCTS
Project Fact Sheet

CONTROLLING NON-PROCESS ELEMENTS AND ORGANIC COMPOUNDS IN PULP MILLS RECOVERING BLEACH FILTRATES

BENEFITS

- Improves control of organics, inorganic non-process elements, and heavy metals in recycled streams
- Reduces the discharge of wastewater from pulping and bleaching operations
- Lessens the environmental impact of pulping and bleaching operations significantly

APPLICATIONS

This research will produce an equilibrium-calculation software package for metal ions in bleach kraft pulp mills and a set of databases that may be used with commercially available process simulation software such as WinGEMS.

Recovery and Reuse of Accumulated Compounds Will Reduce Wastewater Discharges

The pulp industry could substantially reduce the rate at which it generates wastes by recovering and reusing the bleach plant filtrates and evaporator condensates in its wastewater. A number of non-process elements such as barium, calcium, magnesium, aluminum, silica, and heavy metals accumulate in the recycled water, as well as soluble ions such as chloride and organic compounds. These accumulated compounds create deposits and corrosion in plant equipment, decrease paper quality, and release additional pollutants to the environment.

Investigators at Oregon State University and the Institute of Paper Science and Technology want to better understand the effects of these accumulated materials, and to find ways to reduce their impacts and develop cost-effective methods to recover the filtrate. The results of this research will benefit all pulp mills that must reduce their wastewater discharges, whether or not they conduct bleaching operations.

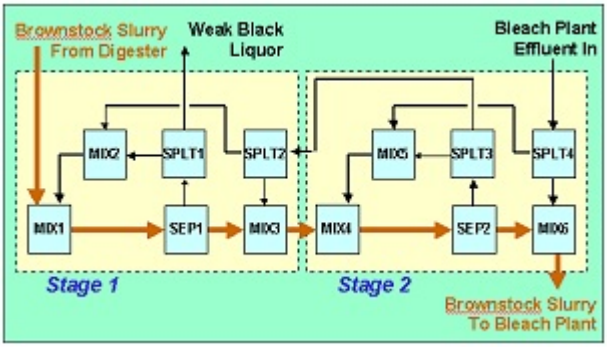

Figure 1. Process diagram of a two-stage brownstock washer.

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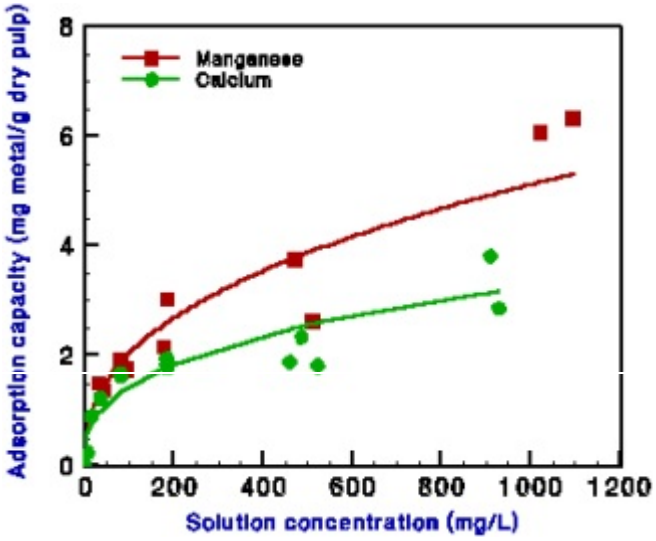
PROJECT DESCRIPTION

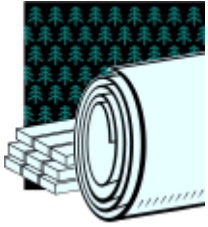
Goal: To develop fundamental, experiment-based methods for predicting the solubility of various types of organic and inorganic matter and their interaction in recycled effluent from kraft pulp mills and bleach plants.

The project consists of four main tasks: (1) To characterize the different types of dissolved organic matter in bleach effluents and develop an understanding of their capacity to form complexes with dissolved metal ions (e.g., Ba, Ca, K, Mg, Na); (2) to investigate how non-process elements, both inorganic and organic, are retained and released by the pulp fiber during various stages of delignification and bleaching; (3) to develop a database of the thermodynamic properties and activity coefficients of all inorganic cations and anions present in kraft pulping liquor and bleach plant effluents, and to couple the database with software packages that calculate chemical equilibrium values to determine the distribution of inorganic ions between wash waters and wood fibers in kraft pulp mills and bleach plants; and (4) to conduct a field study at a bleach pulp mill to validate the ability of the equilibrium models to predict the solubility of the inorganic species of interest in pulp mills and bleach plants. The field study will measure the concentrations of metals, inorganic ions, and dissolved organic matter in mill liquor, bleach filtrates, and pulp streams, and the measured results will be compared with estimates derived from the equilibrium-calculation software.

PROGRESS & MILESTONES

- Mass balances for non-process elements have been completed for three kraft pulp mills and bleach plants.
- The binding sites for cations on wood pulp fibers and organic matter from black liquor and bleach effluents have been identified and quantified.
- The equilibrium adsorption of metal ions on wood pulp fibers has been quantified and modeled. The kinetics of adsorption has also been measured. Sample data for binding of manganese and calcium ions on brownstock wood pulp is provided below (Figure 2).
- Preliminary quantification of the formation of complexes of cations and dissolved organic matter has been completed.
- Databases of thermodynamic properties and ion activity coefficient model parameters for inorganic species have been completed.
- A steady-state mass balance model of a brownstock washer that uses alkaline bleach filtrate as the wash liquor has been completed.





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